U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: **INFORMATION**: PS-ACE100-2002-005; Final Policy Statement; 14 CFR Part 23, § 23.1357(d), Circuit Breakers and Fuses

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Applicability

This policy statement provides clarification of 14 CFR part 23, § 23.1357(d), about installed fuses or circuit breakers, including those used for either primary or secondary (in-line) circuit protection. It also serves to clarify issued policy applicable to this subject contained in Advisory Circular, AC 23-17A. It applies to normal, utility, acrobatic, and commuter category airplanes. It also applies to non-rigid airships certificated in the normal category (14 CFR part 21, § 21.17(b)) with nine seats or fewer, excluding the pilot.

Summary of Policy

14 CFR part 23, § 23.1357(d), has stated the following since its original effective date in 1965:

> "If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse must be so located and identified that it can be readily reset or replaced in flight."

The applicability of the above statement from 14 CFR part 23, § 23.1357(d), depends on whether a function is determined to be "essential to safety in flight." There are two criteria, dependent on the certification basis of the system, that are used to define "essential to safety in flight," as used in 14 CFR part 23, § 23.1357(d). They are the following:

(1) For airplane systems with a certification basis at Amendment 23-40 or earlier: When the function is required by the applicable airworthiness or operational requirements, as listed in 14 CFR part 23, 14 CFR part 91, or 14 CFR part 135, it is considered "essential to safety in flight;" or

(2) For airplane systems with a certification basis at Amendment 23-41 or later: When the failure condition of the loss of the function is determined to be "major," "hazardous," or "catastrophic" [according to § 23.1309 and AC 1309-1C safety assessment, which also

> considers operational and airworthiness requirements], it has a significant impact on safety in flight and is considered "essential to safety in flight."

To clarify, the following table summarizes the applicability of § 23.1357(d).

Certification Basis	Required Equipment*	Non-Required Equipment*
Amdt. 23-40 or earlier	§ 23.1357(d) applies, see statement (1) above	§ 23.1357(d) does not apply.
Amdt. 23-41 or later	§ 23.1357(d) applies if loss of function is determined to be "major," "hazardous," or "catastrophic."**	§ 23.1357(d) applies if loss of function is determined to be "major," "hazardous," or "catastrophic."**

* As required by operational and airworthiness requirements.

** According to § 23.1309 and AC 1309-1C safety assessment, which also considers operational and airworthiness requirements.

If the above criteria show § 23.1357(d) applies, and if the circuit protection devices are internal circuit breakers or fuses that cannot be reset by the pilot, an equivalent level of safety or an exemption is required.

For systems certified using the above criteria under Amendment 23-41 or later, it is acceptable for required equipment whose failure is considered "minor" under § 23.1309 to not meet § 23.1357(d). However, § 23.1357(a) still requires the applicant to show that the resulting design does not present a safety hazard.

Background of Existing Policy

AC 23-17A, "Systems and Equipment Guide for Certification of Part 23 Airplanes," consolidates existing and past policy on circuit protective devices into a single document. The AC clarifies the intent of policy from various guidance materials. It states the phrases "essential to safe operation," as used in part 135, Appendix A, paragraph 64; "essential to flight safety," as used in § 23.1357(b); and "essential to safety in flight," as used in § 23.1357(d); all have the same meaning. Similarly, the words "essential to safety in flight" are found in CAR 3, CAR 4, and 14 CFR part 25, § 25.1357(d). All of these phrases describe equipment installed to comply with the airworthiness or operational requirements.

In 1989, when the criticality of functions such as oil pressure, oil temperature, and fuel quantity were considered, they were not considered "essential to safety in flight." AC 23-17A states this position clearly. Also, AC 23-17A includes the following statement:

> "The FAA recognizes that some required circuit protection devices are associated with circuits that can have no significant impact on safety in flight. Therefore, the responsible Aircraft Certification Office (ACO), and the applicant, should identify which circuits and circuit protection devices are essential to safety in flight. The identified circuits should comply with § 23.1357(d) regarding the pilot's ability to reset them in flight."

The AC does not provide any more guidance to determine what "no significant impact on safety in flight" means; therefore, there has been a lack of standardization within the certification authorities. The term "no significant impact on safety in flight" should be interpreted to be equivalent to "no safety effect" or "minor failure" conditions, as described below.

Function Criticality and Applicability of § 23.1357(d)

Amendment 23-41 addresses the approval of more advanced and complex system designs under § 23.1309 by promoting the use of a safety assessment to assign criticality to each system function. This allows more latitude during certification of various complex system architectures in part 23 airplanes. AC 23.1309-1C, "Equipment, Systems, and Installations in Part 23 Airplanes," documents the safety assessment used to classify the failure condition for the loss of each given function in a system.

According to AC 23.1309-1C, if the failure condition is considered "major," "hazardous," or "catastrophic," the circuit providing the function must have a circuit breaker or fuse that is readily accessible to be reset or replaced in flight. Therefore, the terms of § 23.1357(d) would apply.

In contrast, § 23.1357(d) would not apply for failure conditions only classified as "minor" or "no safety effect" under the terms of a safety assessment according to AC 23.1309-1C. Also, if there are several functions combined on one display and integrated under one protective device, then the total loss of all affected functions should be considered in the safety assessment to determine the criticality for that system failure.

System redundancy may be used to lessen the number of functions that require external circuit protection by reducing the criticality of some functions. However, § 23.1357(a) still requires the applicant to show that their omission does not present a safety hazard.

Example Configurations

For a system being certified under the latest amendment, see the following example of applying this policy:

For an airplane that has two electronic Primary Flight Displays (PFD), plus a Multi-Function Display (MFD) installed strictly to meet part 23 powerplant monitoring requirements, the PFDs would display the required flight critical boundaries. These include altitude, airspeed, attitude, and others.

We assume the classification for the loss of attitude on one PFD in this case is "major," and the loss of altitude or airspeed is "minor." For this system, § 23.1357(d) applies because of the classification of the loss of attitude. Also, both PFDs would be required to meet the airworthiness requirements of § 23.1311(a)(5).

If the MFD is used to display the powerplant limits required by § 23.1305, potential MFD failure conditions resulting in the loss of several powerplant functions at once should be addressed in

the safety assessment. However, if the intended function of the MFD is to display functions that are not required by the airworthiness or operational rules and are only information for situational awareness, such as traffic, weather or terrain, then § 23.1357(d) would not apply to the MFD circuit protection devices.

For a system with two independent PFDs, with an MFD that is also capable of displaying required independent flight critical limits through a reversionary mode, the loss of attitude information on one PFD would be of a lower importance. There would still be two independent sources available to display the critical flight limits. In this case, § 23.1357(d) may not apply for some flight boundaries. A safety assessment would be needed to address other limits that may display on the MFD in a reversionary mode, such as the powerplant boundaries.

Equivalent Level of Safety or Exemption to § 23.1357 for Internal Circuit Protection Devices

Under the latest amendment, if an internal circuit breaker or fuse is installed, and a lack of access to that circuit breaker or fuse would result in a failure classification of "major" or worse, the circuit protection devices and equipment installation should meet the correct § 23.1309 failure probability requirements (as defined in AC 23.1309-1C). In this situation, all the correct environmental test conditions, such as indirect effects of lightning and High Intensity Radiated Fields (HIRF) standards, should be addressed for the installation. To allow approval of these installations, an equivalent level of safety or exemption to § 23.1357 would be needed to comply with the intent of § 23.1357(a) and to show that a no-hazard design has been completed.

Effect of Policy

The general policy stated in this document does not constitute a new regulation and the FAA would not apply or rely on it as a regulation. The FAA Aircraft Certification Offices (ACO) that certificate normal, utility, acrobatic, and commuter category airplanes should try to follow this policy when applicable to the specific project. Whenever an applicant's proposed method of compliance is outside this established policy, it must be coordinated with the policy issuing office as a standard practice.

Applicants should expect the certificating officials will consider this information when making findings of compliance relevant to new certificate actions. Also, as with all advisory material, this policy statement identifies one means, but not the only means, of compliance.

Conclusion

There are two criteria that can be used to determine the applicability of 14 CFR part 23, § 23.1357(d) for a given system related to interpreting the meaning of the phrase "essential to the safety in flight." These are the following:

(1) For systems certified pre-Amendment 23-41, if the function is required by the airworthiness or operational requirements; or

(2) For systems certified under Amendment 23-41 or later, if the failure condition for the loss of function is “major,” “hazardous,” or “catastrophic” according to a § 23.1309 safety assessment. If § 23.1357(d) applies to a circuit protection device, it must be able to be readily reset or replaced in flight. For all designs, the intent of § 23.1357(a) must still be applied and the applicant must show that no hazardous condition exists for the system.

For questions about this policy, please contact Mr. Wes Ryan by telephone at (816) 329-4127, by fax at (816) 329-4090, or by e-mail at wes.ryan@faa.gov.

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